1   1.   A method for guiding a vehicle through a road
2   network from a starting location to a destination, the
3   method comprising:
4   transmitting a specification of the destination to a
5   server; and
6   receiving from the server a specification of a
7   planned route through the road network to the
8   destination.

1   2.   The method of claim 1 further comprising
2   receiving from the server a map that includes a
3   specification of the road network in the vicinity of the
4   planned route.

1   3.   The method of claim 1 wherein the specified
2   part of the road network is in the vicinity of the
3   starting location.

1   4.   The method of claim 1 wherein the specification
2   of the planned route includes specifications of a
3   plurality of maneuvers to be carried out by the vehicle,
4   and wherein the specification of each maneuver includes a
5   location of the maneuver.

1   5.   The method of claim 1 wherein the specified
2   part of the road network is in the vicinity of one or
3   more maneuver locations.

1   6.   The method of claim 1 further comprising
2   displaying the received map in conjunction with a

3 representation of the planned route, and a location of

4 the vehicle.

1   7.   The method of claim 6 further comprising

2 estimating the location of the vehicle, and detecting

3 when the vehicle is following the planned route.

4   8.   A method for guiding a vehicle comprising:

5   transmitting a specification of a location to a

6 server; and

7   receiving from the server a map that includes a

8 specification of the a network in the vicinity of the

9 specified location.

1   9.   Software recorded on a computer readable medium

2 for causing an in-vehicle computer to perform the

3 functions of:

4   sending a specification of a destination to a

5 server;

6   accepting from the server a specification of a

7 planned route through a road network to the destination;

8 and

9   accepting from the server a map that includes a

10 specification of the road network in the vicinity of the

11 planned route.

1   10. A method for providing navigation information

2 to a vehicle comprising:

3   receiving from a vehicle a specification of a

4 destination;

5   determining a planned route on a road network to the

6 destination;

7   transmitting to the vehicle a specification of the

8   planned route; and

9   transmitting to the vehicle a map that includes a
10 specification of the road network in the vicinity of the
11 planned route.

1   11. A method for tracking a vehicle comprising:
2   receiving a reference signal from a positioning
3   system;
4   computing position data related to the location of
5   the vehicle using the received reference signal;
6   transmitting the position data to a server;
7   receiving from the server position correction data;
8   determining estimated coordinates of the vehicle
9   including combining data computed from the received
10 reference signal and the position correction data.

1   12. The method of claim 11 wherein computing the
2   position data, and determining the estimated coordinates,
3   including combining the position data and the position
4   correction data, are performed repeatedly for an interval
5   of time using the same received position correction data,
6   and the method further comprises, subsequent to the
7   interval of time, repeatedly computing the position data
8   and determining estimated coordinates of the vehicle
9   using the position data without using the correction
10 data.

1   13. The method of claim 12 wherein:
2   receiving the reference signal from a positioning
3   system includes receiving signals from a plurality of
4   positioning satellites;
5   computing the position data includes computing a
6   range measurement to each of the positioning satellite;

7   receiving the position correction data includes

8   receiving range correction data for range measurements to

9   the positioning satellites; and

10   combining the position data and the position

11   correction data includes combining the range measurements

12   and the range correction data.

1   14. The method of claim 12 wherein:

2   receiving the position correction data includes

3   receiving a location correction; and

4   combining the position data and the position

5   correction data includes computing uncorrected

6   coordinates from the position data and adding the

7   location correction to the uncorrected coordinates to

8   determine the estimated location of the vehicle.

1   15. Software recorded on a computer readable medium

2   for causing an in-vehicle computer to perform the

3   functions of:

4   receiving a reference signal from a positioning

5   system;

6   computing position data related to the location of

7   the vehicle using the received reference signal;

8   transmitting the position data to a server;

9   receiving from the server position correction data;

10   determining estimated coordinates of the vehicle

11   including combining data computed from the received

12   reference signal and the position correction data.

1   16. An in-vehicle navigation system comprising:

2   a positioning system receiver for receiving

3   reference signals from a positioning system;

4   a wireless communication interface for accepting

5 data signals from a server; and

6   a processor coupled to the positioning system and to

7 the wireless communication system, wherein the onboard

8 computer is programmed to perform the functions of

9   accepting reference data from the positioning

10 system receiver,

11   determining position data from the reference

12 data,

13   providing the position data to the wireless

14 communication interface for transmission to the server,

15   accepting position correct data from the

16 communication interface, and

17   determining estimated coordinates for the

18 vehicle from the reference data and the accepted position

19 correction data.

1   17. The system of claim 16 wherein the processor is

2 further programmed to perform the function of timing an

3 interval during which it determines the estimated

4 coordinates for the vehicle from the reference data and

5 the accepted position correction data, and after which it

6 determines the estimated coordinates for the vehicle from

7 the reference data and without using the accepted

8 position correction data

1   18. A method for tracking a vehicle comprising:

2   receiving a specification of a first location, the

3 specification including coordinates of the first

4 location;

5   determining when the vehicle is at the first

6 location;

7   computing first position data using a reference

8 signal received from a positioning system at the time at

9   which the vehicle was determined to be at the first

10 location;

11   computing position correction data using the first

12 position data and the coordinates of the first location;

13   computing second position data using a reference

14 signal received from the positioning system at a second

15 time subsequent to the time at which that the vehicle was

16 determined to be at the first location;

17   determining coordinates of the vehicle at the second

18 time including combining the correction data and the

19 second position data.

1   19. The method of claim 18 wherein the

2 specification of the first location includes a

3 specification of a maneuver to be carried out by the

4 vehicle at the first location, and determining when the

5 vehicle is at the first location includes detecting when

6 the vehicle performs the specified maneuver.

1   20. Software recorded on a computer readable medium

2 for causing an in-vehicle computer to perform the

3 functions of:

4   receiving a specification of a first location, the

5 specification including coordinates of the first

6 location;

7   determining when a vehicle is at the first location;

8   computing first position data using a reference

9 signal received from a positioning system at the time at

10 which the vehicle was determined to be at the first

11 location;

12   computing position correction data using the first

13 position data and the coordinates of the first location;

14   computing second position data using a reference

15 signal received from a positioning system at a second

16 time subsequent to the time at which that the vehicle was

17 determined to be at the first location;

18   determining coordinates of the vehicle at the second

19 time including combining the correction data and the

20 second position data.

1   21. A vehicle navigation system comprising:

2   a positioning system receiver for receiving

3 reference signals from a positioning system;

4   a first storage for holding a specification of a

5 first location, the specification including coordinate of

6 the first location;

7   a second storage for holding position correction

8 data;

9   a vehicle sensor for sensing motion of the vehicle;

10 and

11   a processor coupled to the positioning system

12 receiver, to the first and the second storage, and to the

13 vehicle sensor, and programmed to perform the functions

14 of

15   determining when the vehicle is at the first

16 location using signals from the vehicle sensor,

17   accepting first reference data related to the

18 location of the vehicle at the time at which the vehicle

19 was determined to be at the first location from the

20 positioning system receiver,

21   computing position correction data using the

22 first reference data and the coordinates of the first

23 location, and

24   determining coordinates of the vehicle at a

25 second time subsequent to the time at which that the

26 vehicle was determined to be at the first location using
27 the computed position correction data.

1   22.   A method for detecting when a vehicle deviates
2 from a planned route comprising:
3   tracking a first estimated position of the vehicle
4 using signals from a positioning system that are received
5 at the vehicle;
6   tracking a second estimated position of the vehicle
7 using an estimate of the distance traveled along the
8 planned route;
9   detecting that the vehicle has deviated from the
10 planned route when the first estimated position and the
11 second estimated position differ by at least a tolerance
12 distance.

1   23.   The method of claim 22 wherein the planned
2 route includes a first point and a path following the
3 first point, and wherein tracking the second estimated
4 position includes detecting when the vehicle is at the
5 first point on the planned route and estimating the
6 distance traveled along the path following the first
7 point.

1   24.   The method of claim 23 further comprising
2 adjusting the tolerance distance, including reducing the
3 tolerance distance when the vehicle is detected to be at
4 the first point on the planned route, and increasing the
5 tolerance distance as the vehicle travels along the path
6 following the first point.

1   25.   Software recorded on a computer readable medium
2 for causing an in-vehicle computer to perform the

3   functions of:

4   tracking a first estimated position of a vehicle

5   using signals from a positioning system that are received

6   at the vehicle;

7   tracking a second estimated position of the vehicle

8   using an estimate of the distance traveled along the

9   planned route;

10   detecting that the vehicle has deviated from the

11   planned route when the first estimated position and the

12   second estimated position differ by at least a tolerance

13   distance.

1   26. A vehicle tracking system comprising:

2   a first position estimator including a positioning

3   system receiver, for determining a first estimate of the

4   vehicle's location determined using information received

5   from the positioning system receiver;

6   storage for a planned route;

7   a second position estimator coupled to a vehicle

8   motion sensor and to the storage for the planned route,

9   for determining a second estimate of the vehicle's

10   location using information received from the vehicle

11   sensor and the planned route; and

12   an off-route detector coupled to the first position

13   estimator and to the second position estimator, for

14   comparing the first estimate of the vehicle's position

15   and the second estimate of the vehicle's position.